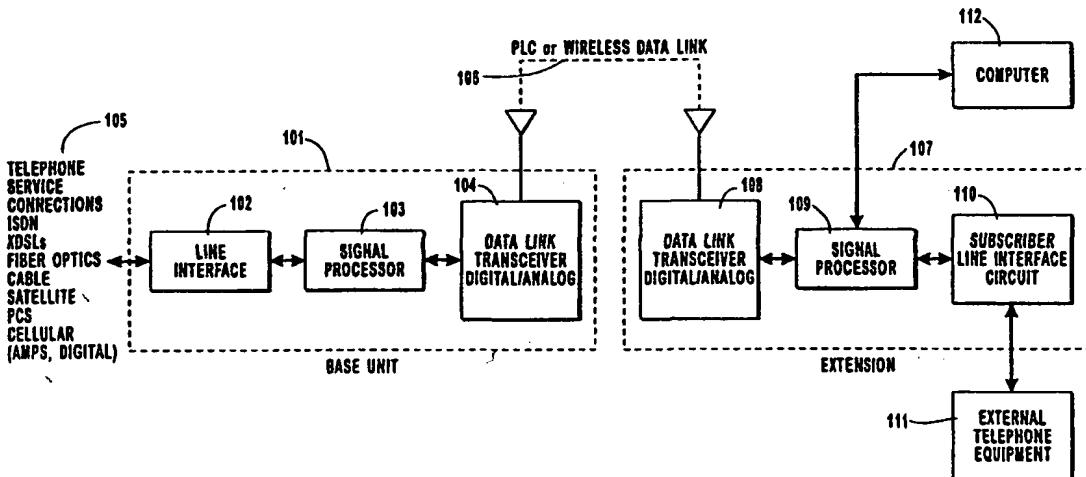




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(54) Title: DISTRIBUTION SYSTEM FOR EXTERNAL COMMUNICATION SIGNALS AND DATA



(57) Abstract

Claims
A distribution system for communicating signals and data without the need for continuous telephone lines is described. This system provides a base unit (101) connected to incoming signals (105) such as cable, satellite, PCS, cellular, fiber optics, XDSL, ISDN, etc., one or more extension units (107) connected to the user's telephone or electronics equipment (111, 112) and a communication link (106) between the base unit and the one or more extension units. The preferred communication link is an A/C power line carrier or alternatively a wireless RF channel. This system provides for the distribution of communication signals from a variety of sources through out a building or office without requiring dedicated telephone lines. This invention, in one of its preferred embodiments, is specially adapted to meet the technical requirements of A/C power line communications.

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DISTRIBUTION SYSTEM FOR EXTERNAL COMMUNICATION SIGNALS AND DATA

5

Background of the Invention

Field of the Invention. This invention relates to electronic communication systems for both data and voice signals. More specifically, the invention relates to the distribution of signals from a variety of sources, including conductor cable; satellite;

Claimed PCS; Cellular (both AMPS and Digital); fiber optic cable; XDSLs; ISDN lines, to one or more in-building telephones, computers or other electronic devices using A/C power lines or wireless RF as a channel of communication.

Description of Related Art. A variety of power line and wireless telephone voice and/or data communication systems have been developed and are used to facilitate communication in locations where there is little or no availability of dedicated 10 telephone/data wires. While these approaches may address some of the problems encountered in power line or wireless communications they typically do not address the issues associated with the distribution of signals to a variety of receivers which may be connected into the communication channel. Prior systems for power line or wireless communications, to which the reader is directed for background, includes the 15 following United States and foreign patent documents: 2,510,273, 2,516,211, 2,516,763, 2,535,446, 2,567,908, 2,577,731, 2,654,805, 2,820,097, 2,828,363, 2,932,794, 3,045,066, 3,280,259, 3,334,185, 3,369,078, 3,399,397, 3,400,221, 20 3,475,561, 3,521,267, 3,529,216, 3,659,280, 3,693,155, 3,796,920, 3,810,096,

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PCT/US93/04726, PCT/US94/03110, and PCT/US95/00354 each of which is hereby
incorporated by reference in its entirety for the material disclosed therein.

Summary of the Invention

5 It is desirable to provide a means for distributing communication signals
between a variety of sources and a variety of destinations within buildings without
requiring dedicated wired telephone lines, using such communication channels as A/C
power lines or wireless RF. It is particularly desirable to provide a distribution
system which is adapted to the unique requirements of A/C power line and wireless
10 RF communication channels. Wireless and A/C power line communication systems
provide many important advantages over wired telephone line systems. This is
particularly the case where standard telephone jacks are limited or unavailable, or
where multiple devices require communication over the same channel. Many of the
advantages are discussed in further detail in the previously cited patent literature.

15 Accordingly, it is the primary object of this invention to provide a distribution
system for the communication of signals and data which makes use of A/C power
lines or wireless RF signals and which provides for the distribution of the signals and
data to one or more of several destinations.

Another object of this invention is to provide a distribution system for the
20 communication of signals and data which provides a base unit which is connected to
the incoming external signal sources.

Another object of this invention is to provide a distribution system for the
communication of signals and data which provides an extension unit connected to

telephone or electronic equipment for receiving signals from the A/C power line or wireless RF channel and sending signals across the A/C power line or wireless RF channel to the external communication equipment.

A further object of this invention is to provide a distribution system for the
5 communication of signals across A/C power lines or wireless RF signals where error correction is performed to maintain data integrity.

A still further object of this invention is to provide a distribution system for the communication of signals across A/C power lines or wireless RF signals using a digital communications link.

10 It is still a further object of this invention to provide a distribution system for the communication of signals across A/C power lines or wireless RF signals using a modulation scheme in the family of Pulse Shift Key modulation.

It is a further object of this invention to provide a distribution system for the
communication of signals across A/C power lines or wireless RF signals using data
15 encoding for security of the signals between units.

It is still another object of this invention to provide a distribution system for the communication of signals across A/C power lines or wireless RF signals where the extension unit is provided with the means of connecting directly to a digital computer, an entertainment system and/or a telephone receiving digital information.

20 Additional objects, advantages, and other novel features of this invention will be set forth in part in the description that follows and in part will become apparent to those skilled in the art upon examination of the following or may be learned with the practice of the invention. The objects and advantages of this invention may be

realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims. Still other objects of the present invention will become readily apparent to those skilled in the art from the following description wherein there is shown and described the preferred embodiment of this invention.

5 simply by way of illustration of one of the modes best suited to carry out this invention. As it will be realized, this invention is capable of other different embodiments, and its several details, and specific electronic circuits, are capable of modification in various aspects without departing from the invention. Accordingly, the drawings and descriptions should be regarded as illustrative in nature and not as

10 restrictive.

To achieve the foregoing and other objectives, and in accordance with the purposes of the present invention, a base unit and an extension unit are provided. The base unit includes a line interface circuit; a signal processor and a data link transceiver. The extension unit includes a data link transceiver, a signal processor,

15 and a means for connecting the extension unit to a computer, and entertainment system and/or a communication device.

Brief Description of the Drawings

The accompanying drawings incorporated in and forming a part of the specification, illustrate a preferred embodiment of the present invention. Some, 20 although not all, alternative embodiments are described in the following description.

In the drawings:

Figure 1 is a top level block diagram showing the major sections of the invention.

Figure 2 is a block diagram showing the major component sections of the base unit of the invention.

Figure 3 is a block diagram showing the major component sections of the extension unit of the invention.

5 Reference will now be made in detail to the present preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings.

Detailed Description of the Invention

Figure 1 shows the top level distribution system of the preferred embodiment of the invention. The base unit 101 is shown having three major components: a line interface 102, a signal processor 103 and a data link transceiver 104. The extension unit 107 is shown having three major components: a data link transceiver 108, a signal processor 109 and a subscriber line interface circuit 110. The base unit 101 receives telephone type service connections 105 by connection to the line interface 102. The telephone type service connections 105 can be of a wide variety of types,

10 including but not limited to: ISDN, XDSLs, fiber optic, cable, satellite, PCS and cellular. The line interface 102 is used to connect to the different kinds of signals encountered in the wide variety of telephone type service connections 105. These incoming signals can be digital, analog, packetized. The line interface 102 further provides the interface between the telephone type service connections 105 and the signal processor 103. The signal processor 103 processes the data resident in the signals received or to be sent to the telephone type service connections 105. Such processing includes: formatting and error correcting for the digital data. Furthermore, the signal processor 103 acts as the controller for the data link transceiver 104. The

Claim 1

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Claim 2

Claim 2

data link transceiver 104 performs the modulation/demodulation of the digital and/or analog data and both transmits and receives the data over the link 106 to the extension unit 107. The link 106, in the preferred embodiment is over the A/C powerlines, although, alternatively, the link 106 may be a wireless RF channel, that is through the airwaves. On the other side of the link 106 is the extension unit 107 data link transceiver 108, which performs the modulation/demodulation of the digital and/or analog data and both transmits and receives the data across the link 106 to the base unit 101 data link transceiver 104. Connected to the data link transceiver 108 is the signal processor 109 of the extension unit 107. Similar to the signal processor 103 of the base unit 101, this signal processor 109 formats the data, provides the error correction function and controls the data link transceiver 108. However, unlike the signal processor 103 of the base unit 101, this signal processor 109 is provided with a direct connection to a digital computer device 112 and this signal processor 109 is connected to a subscriber line interface circuit (SLIC) 110 which in turn provides the interface to external telephone equipment 111. This preferred embodiment of the invention makes use of standard electrical components and is adapted to work with standard telephone equipment and telephone service connections. Alternatively, special purpose electronic devices could be substituted and foreign or custom telephone equipment and/or connections could be supported without departing from the concept of this invention.

Figure 2 shows component sections of the base unit of the preferred embodiment of the invention. A preferred embodiment of the invention, using the A/C power line link 106 having the base unit 101 viewed in terms of the functional

Tx Side
deformat
Rx Side
format
data

blocks is shown here. Data is both received and sent through the data interface 201 to the external signals 105. The data interface 201 function conditions the data for use by the system processor 202. The system processor 202 performs the functions necessary to control the base unit 101, format the data, add error correction and is the central controller for the base unit 101. Electrically connected to the system processor 202, the transceiver 203 provides the data link modulation and demodulation as well as providing the carrier signal for data transmission and reception. In the case of the A/C power line link 106, a power conditioning unit 204 is provided to interface data signals on to the A/C power line 205. Data that is provided to the SLIC in a standard wired telephone system, in this invention is transmitted to and from the power lines 205 (or alternatively a wireless RF channel) using a digital communications system.

The preferred modulation scheme for the use across the link 106 is OQPSK, since this modulation scheme has good spectral efficiency and is cost effective for both modulation and demodulation. Alternative modulation schemes can be substituted without departing from the concept of this invention. Typically, in this preferred power line link embodiment, the base unit 101 receives digital data from the telephone service connection s 105, from a cable or other connection means, encodes the data, adds forward error correction to reduce data errors and to ensure reliable data communications, adds data scrambling for security between units and sends this processed data over the power line to the extension units 107.

Figure 3 shows the component sections of the extension unit of the preferred embodiment of the invention. A preferred embodiment of the extension unit 107 of the invention, using the A/C power line link 106, viewed in terms of the functional

blocks is shown here. In this embodiment of the extension unit 107 a power supply and conditioning unit 301 provides both the interface to the power line link 106 and the electrical power for the extension unit 107. Communicating with the power supply and conditioning unit 301 is a transceiver 302, which in the preferred 5 embodiment is a digital PLC transceiver. This transceiver 302 performs essentially the same function as described above concerning the base unit 101 transceiver 203, that is, it modulates and demodulates, transmits and receives the signal and is controlled by the system processor 303. The system processor 303 controls the function of the extension unit 107, as well as formatting the data and providing the 10 forward error correction for the extension unit 107. This system processor 303 also is provided with a direct connection to a digital computer device 306, bypassing the subscriber line interface circuit 304. A subscriber line interface circuit 304 is electrically connected to the system processor 303 to provide the interface to the external telephone type devices 305. The subscriber line interface circuit 304 15 includes a codec. The preferred extension unit, using an A/C power line link 106 is provided with pass-through power connectors to filter out unwanted interference in the extension unit 107.

The foregoing description is of a preferred embodiment of the invention and has been presented for the purposes of illustration and as a description of the best 20 mode of the invention currently known to the inventors. It is not intended to be exhaustive or to limit the invention to the precise form, connections, or choice of components disclosed. Obvious modifications or variations are possible and foreseeable in light of the above teachings. This embodiment of the invention was

chosen and described to provide the best illustration of the principles of the invention and its practical application to thereby enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when they are interpreted in accordance with the breadth to which they are fairly, legally and equitably entitled.

Claims

We claim:

1. A distribution system for communication of signals and data, comprising:
 - (A) a base unit;
 - 5 (B) an extension unit; and
 - (C) a communication link connecting said base unit to said extension unit.
2. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a line interface adapted to send and receive signals from a variety of telephone service connections.
- 10 3. A distribution system for communication of signals and data as recited in claim 2 wherein said variety of telephone service connection is selected from the group consisting of ISDN, XDSL, fiber optics, cable, satellite, PCS and cellular.
4. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a system processor for controlling said base unit.
- 15 5. A distribution system for communication of signals and data as recited in claim 4, wherein said system processor formats the data.
6. A distribution system for communication of signals and data as recited in claim 4, wherein said system processor performs error correction.
- 20 7. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a transceiver for providing modulation of the signals.

8. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a transceiver for demodulating the signals.
9. A distribution system for communication of signals and data as recited in 5 claim 1, wherein said base unit further comprises a transceiver for sending and receiving the signals.
10. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a transceiver using a PSK modulation scheme.
- 10 11. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a transceiver using a frequency hop modulation scheme.
12. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a power conditioning unit to 15 provide an electrical interface to an A/C power line.
13. A distribution system for communication of signals and data as recited in claim 1, wherein said communication link is a power line carrier communication channel.
14. A distribution system for communication of signals and data as recited in 20 claim 1, wherein said communication link is wireless RF communication channel.

15. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a power supply for providing electrical power to said extension unit.
16. A distribution system for communication of signals and data as recited in 5 claim 1, wherein said extension unit further comprises a power conditioning unit for interfacing said extension unit with an A/C power line.
17. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a transceiver for providing modulation of the signals.
- 10 18. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a transceiver for demodulating the signals.
19. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a transceiver for sending and receiving the signals.
- 15 20. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a transceiver using a PSK modulation scheme.
21. A distribution system for communication of signals and data as recited in
20 claim 1, wherein said extension unit further comprises a transceiver using a
frequency hop modulation scheme.

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22. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a system processor for controlling said extension unit.
23. A distribution system for communication of signals and data as recited in 5 claim 4, wherein said system processor formats the data.
24. A distribution system for communication of signals and data as recited in claim 4, wherein said system processor performs error correction.
25. A distribution system for communication of signals and data as recited in 10 claim 4, wherein said system processor interfaces with a digital electronic computer.
26. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a subscriber line interface circuit having a codec and with the ability to connect electrically with standard telephone communications devices.
- 15 27. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a subscriber line interface circuit having a codec and having the ability to connect electrically with a digital telephone.
28. A distribution system for communication of signals and data as recited in 20 claim 1, wherein said extension unit further comprises a subscriber line interface circuit having a codec and having the ability to connect electrically with a digital television.

29. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a subscriber line interface circuit having a codec and having the ability to connect electrically with a digital audio system.
- 5 30. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a subscriber line interface circuit having a codec and having the ability to connect electrically with a digital tele-conferencing device.
31. A distribution system for the communication of signals and data, comprising:
 - 10 (A) a base unit;
 - (B) a plurality of extension units; and
 - (C) a communication link connecting said base unit to said plurality of extension units.
32. A distribution system for the communication of signals and data, comprising:
 - 15 (A) a plurality of base units;
 - (B) an extension unit; and
 - (C) a communication link connecting said plurality of base units to said extension unit.

AMENDED CLAIMS

[received by the International Bureau on 12 September 1999 (12.09.99); original claims 1, 31 and 32 amended; remaining claims unchanged (5 pages)]

1. A distribution system for communication of signals and data, comprising:

(A) a base unit, wherein said base unit further comprises a service connection

5 selected from the group consisting of XDSL, fiber optics, cable, satellite, PCS and cellular;

(B) an extension unit; and

(C) a communication link connecting said base unit to said extension unit.

2. A distribution system for communication of signals and data as recited in

10 claim 1, wherein said base unit further comprises a line interface adapted to send and receive signals from a variety of telephone service connections.

3. A distribution system for communication of signals and data as recited in

claim 2 wherein said variety of telephone service connection is selected from the group consisting of ISDN, XDSL, fiber optics, cable, satellite, PCS and cellular.

15 4. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a system processor for controlling said base unit.

5. A distribution system for communication of signals and data as recited in

claim 4, wherein said system processor formats the data.

20 6. A distribution system for communication of signals and data as recited in claim 4, wherein said system processor performs error correction.

7. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a transceiver for providing modulation of the signals.

8. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a transceiver for demodulating the signals.
- 5 9. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a transceiver for sending and receiving the signals.
10. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a transceiver using a PSK modulation scheme.
11. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a transceiver using a frequency hop modulation scheme.
12. A distribution system for communication of signals and data as recited in claim 1, wherein said base unit further comprises a power conditioning unit to provide an electrical interface to an A/C power line.
- 15 13. A distribution system for communication of signals and data as recited in claim 1, wherein said communication link is a power line carrier communication channel.
- 20 14. A distribution system for communication of signals and data as recited in claim 1, wherein said communication link is wireless RF communication channel.

15. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a power supply for providing electrical power to said extension unit.
- 5 16. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a power conditioning unit for interfacing said extension unit with an A/C power line.
17. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a transceiver for providing modulation of the signals.
- 10 18. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a transceiver for demodulating the signals.
19. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a transceiver for sending and receiving the signals.
- 15 20. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a transceiver using a PSK modulation scheme.
- 20 21. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a transceiver using a frequency hop modulation scheme.

22. A distribution system for communication of signals and data as recited in
claim 1, wherein said extension unit further comprises a system processor for
controlling said extension unit.
23. A distribution system for communication of signals and data as recited in
5 claim 4, wherein said system processor formats the data.
24. A distribution system for communication of signals and data as recited in
claim 4, wherein said system processor performs error correction.
25. A distribution system for communication of signals and data as recited in
claim 4, wherein said system processor interfaces with a digital electronic
10 computer.
26. A distribution system for communication of signals and data as recited in
claim 1, wherein said extension unit further comprises a subscriber line
interface circuit having a codec and with the ability to connect electrically
with standard telephone communications devices.
- 15 27. A distribution system for communication of signals and data as recited in
claim 1, wherein said extension unit further comprises a subscriber line
interface circuit having a codec and having the ability to connect electrically
with a digital telephone.
28. A distribution system for communication of signals and data as recited in
20 claim 1, wherein said extension unit further comprises a subscriber line
interface circuit having a codec and having the ability to connect electrically
with a digital television.

29. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a subscriber line interface circuit having a codec and having the ability to connect electrically with a digital audio system.

5 30. A distribution system for communication of signals and data as recited in claim 1, wherein said extension unit further comprises a subscriber line interface circuit having a codec and having the ability to connect electrically with a digital tele-conferencing device.

31. A distribution system for the communication of signals and data, comprising:

- 10 (A) a base unit, wherein said base unit further comprises a service connection selected from the group consisting of XDSL, fiber optics, cable, satellite, PCS and cellular;
- (B) a plurality of extension units; and
- (C) a communication link connecting said base unit to said plurality of extension
- 15 units.

32. A distribution system for the communication of signals and data, comprising:

- (A) a plurality of base units, wherein each said base unit further comprises a service connection selected from the group consisting of XDSL, fiber optics, cable, satellite, PCS and cellular;
- 20 (B) an extension unit; and
- (C) a communication link connecting said plurality of base units to said extension unit.

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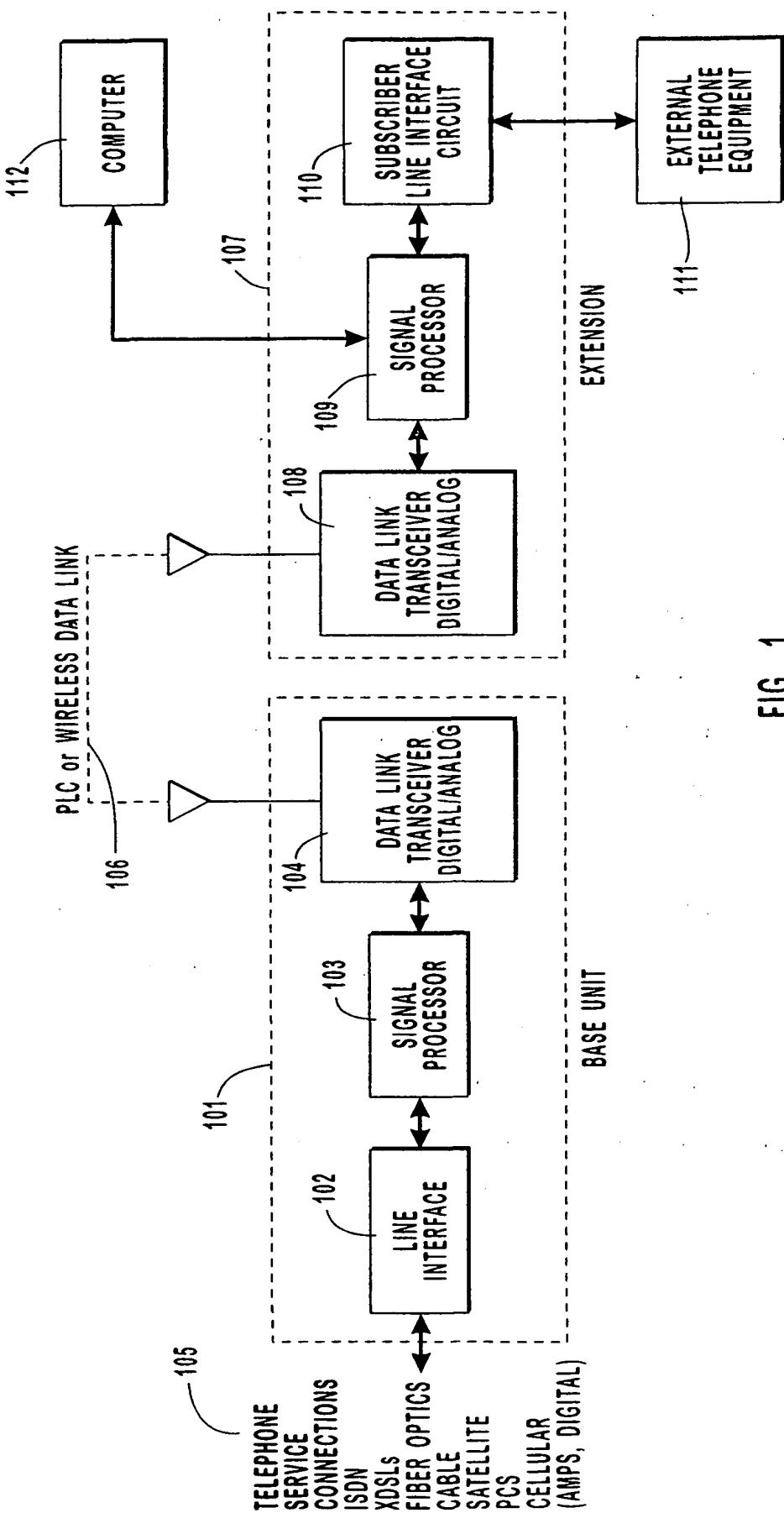


FIG. 1

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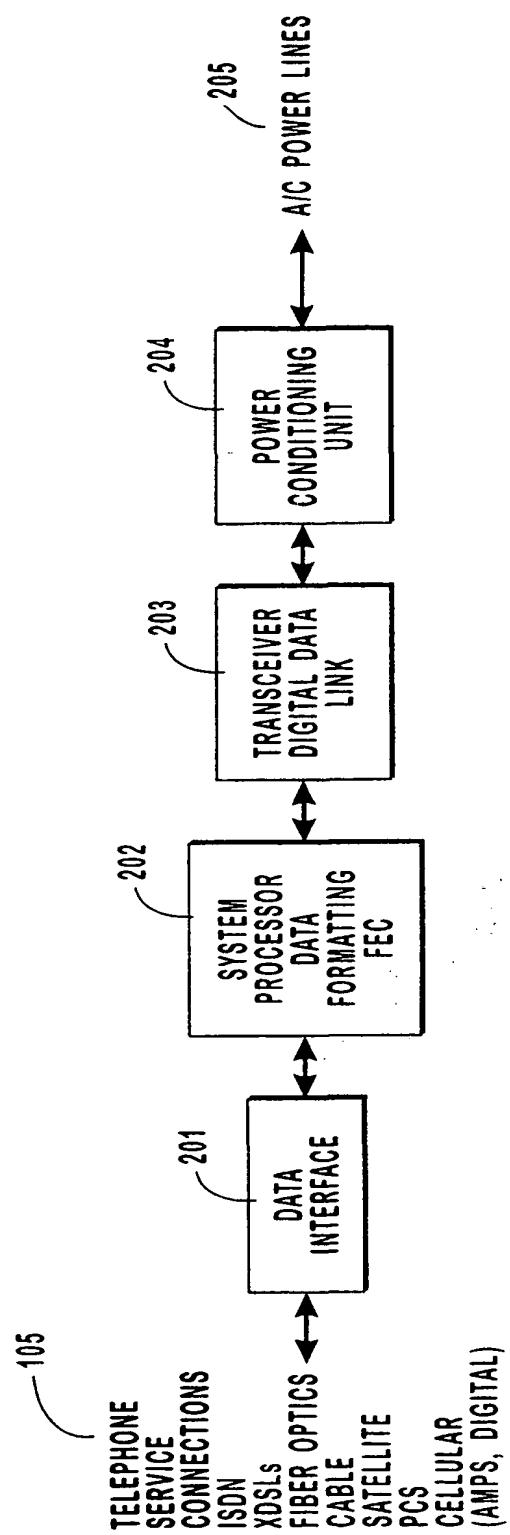


FIG. 2

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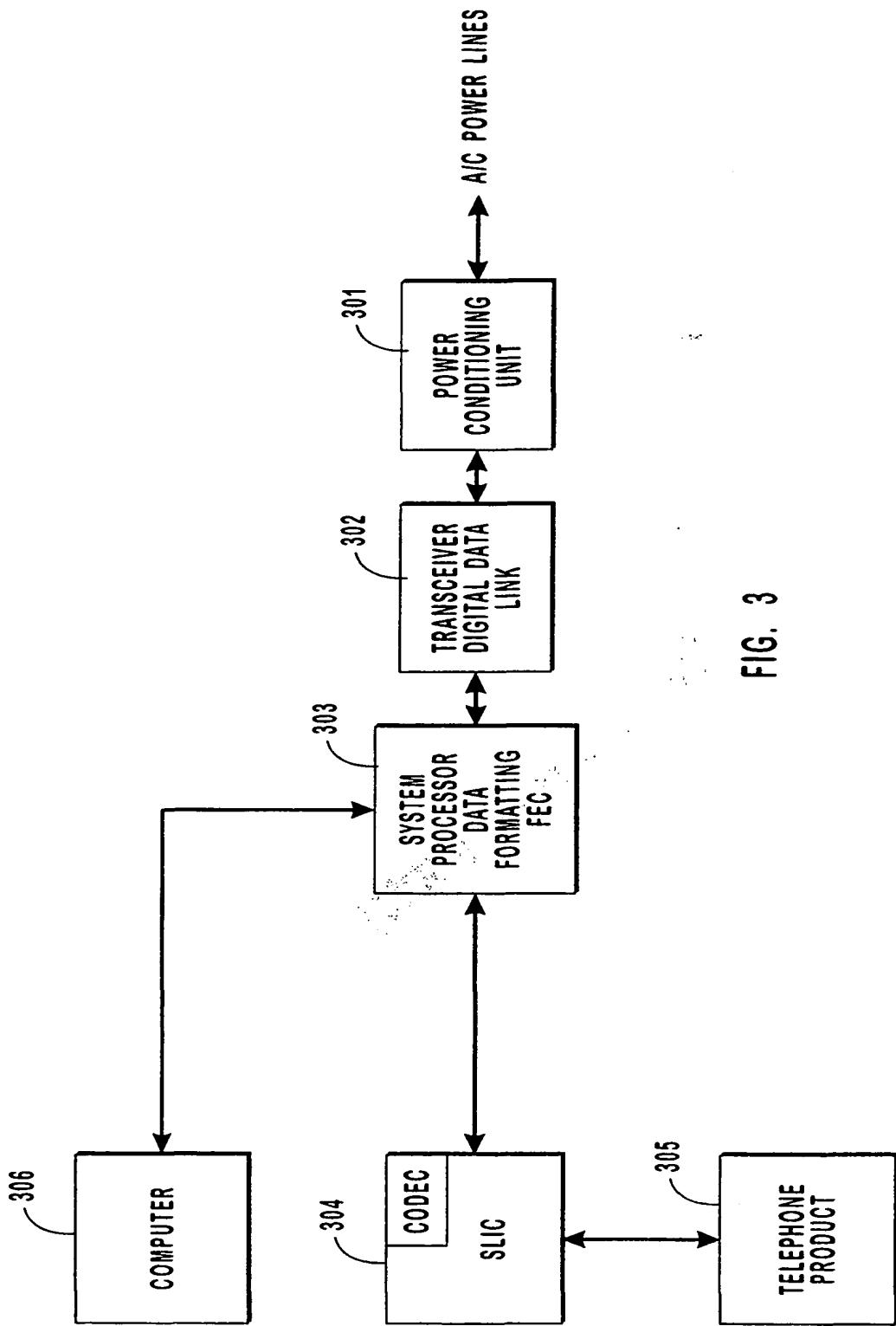


FIG. 3

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/07734

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04B 1/38; H04L 5/16

US CL :375/219, 220

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 375/219, 220

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,319,634 A (BARTHOLOMEW et al.) 07 JUNE 1994, Figs. 1, 2, 4-6, and cols. 4-8.	1-32
X	US 5,903,835 A (DENT) 11 May 1999, Fig. 8.	1-24

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means		
P document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

14 MAY 1999

Date of mailing of the international search report

13 JUL 1999

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